



COPIES OF PAPERS  
ORIGINALLY FILED

1

SEQUENCE LISTING

<10> NELSON, DAVID R.

<120> A LIVE, AVIRULENT STRAIN OF *V. ANGUILLARUM* THAT PROTECTS FISH AGAINST INFECTION BY VIRULENT *V. ANGUILLARUM*

#5

<130> 5112

<140> 09/915,706

<141> 2001-07-26

<160> 4

<170> PatentIn Ver. 2.1

<210> 1

<211> 3588

<212> DNA

<213> *Vibrio anguillarum*

<220>

<221> modified\_base

<222> (3572)

<223> a, t, c, g, other or unknown

<400> 1

gtcgacttat	tgcattgatg	gcgtacatgg	tagtgccatc	cttcgtttgc	taacaagcgt	60
tgtataaaaag	cttggtcggg	ttcatcaagt	tgaacacaat	actcatgatt	tttcccactt	120
ccggaaaaggg	aaaagtgaaa	atagcttttg	agatcagcct	gttctagcag	cttttcaatg	180
atcttttttcg	tcgttacggt	ttgaaaaatc	tgacgactgc	gtttgtattg	caacaagcta	240
agtggatcca	atatctctat	ttgataataa	aactgctgct	tgtctttgct	atatcctgtg	300
aattgcagag	tgctacatat	acctgaaaaa	aaacgctttc	cagaatctaa	ttcgtaagac	360
acacaaacag	ctttacctag	gttttttggt	tcgatctcca	tgtttgccgc	gatggaaacg	420
gaaaactgac	acccgccgga	tacgctttcc	tctccgatta	attgcgtgac	aatataactt	480
ttgctatctg	aaagcttaat	ggtgaggagg	cgggtttggg	gctttaattc	gttactgctc	540
atattcaatt	aattcactat	taaataaaca	gttctaaaag	gctgtttatt	ggatgaatat	600
tcgaaattat	cacataataa	ttgatgctat	tattacttgc	tgtattggta	tcaactttca	660
tgctctatac	atgtaataa	tttcgagtta	gaccttaatt	caaggtaatt	tgtctattta	720
attattatct	gaataatatg	taatcgattg	ctttgtgggt	atttttatgt	ttgtttcatt	780
tttaatgacg	gtgagcttgt	gcattcatat	tttttatgat	gacaacatct	ttgatgaagt	840
atttaagata	ttgttaatgc	atgagggggt	tgctgtgatt	ttttatatta	aatcataata	900
aaatcaacaa	tatatgttat	tttgtgtcct	tttatagtg	tcttttaaag	aggtaggatg	960
acctaaagg	cgctaaata	tggcgtaaat	tgccattgct	ataattcacc	tcaaagatac	1020
actattggca	aattgacaaa	tatgtcactt	cgatgaaac	aatattagta	gatggtgttt	1080
ttgctgcaaa	aataaaaaat	tttctgggtg	aaataactca	aggcctctag	cgttttcctt	1140
tatcttaaaa	tacaggaaat	agcgattgaa	gttaattgac	acttaagcaa	atagtcaacc	1200
taacagagca	ggaacctatg	cctttgtcaa	agcatcaa	tgagcaactt	tctaaacctc	1260
tgagtgatga	ttcgatctgt	ggcgtttatc	ttaaactgga	aaaaagtgtc	tttcgcccac	1320
tacgtaaatga	atttaatgtc	gcgcaaactg	cgctgcgtaa	gctaagtcaa	aaccctagt	1380
ctgacgagag	agatgcgtta	caagaggcat	gtctaaataa	gtggaagatt	ctctctgaca	1440
gtttgtacga	acagttttca	aaaacaacca	gagatatcga	gctcatctca	tggtttgttg	1500
ctgctcaatt	ccttctcgat	accacattag	aaagtgtgtc	gaatagcctt	gagtgggttag	1560
cggatttaag	tgagaagcac	tgggatcacc	tcaacctgt	actaccagt	gaaacgctca	1620
aatctgatga	tgataagggc	aaagaaaag	agcaagcaga	tgcgaaagt	aaagcatttt	1680
tccaactagt	cggcgatagc	gaggaaaagc	cgattctcta	tgccgagggt	ctgcaactgc	1740
ccttagtcgg	ggaagtgcac	ttttttgact	ttcaaagtgc	agagagaaaa	ggcgaaatca	1800

```

gccaaactgaa atctatgctt acgaccacgg tggcgcaaa gggtttcgca attcaattca 1860
agatggaaaa cgccaaacgt tgtgtcacc aattagatcg tctgtcagcg ttggtgagca 1920
ctaagtgtca ttctctaggg agtcaaagta ccaacttcgg atttgogaag tcaactgctta 1980
cccgtgttga aaacgctttg gttcatctaa gtggaatcga gtttagcaccg aaagcggagg 2040
ccaagacagt agagcaagag gttgccgaaa gttcagtttc cgaaggggag ctgccaaaggc 2100
atatggatac aaaacatata gagcgaatac cgatggcttc agagcagggt cagaccgtaa 2160
gccaaacactt acacgcagga aacctctctg aactgggttaa tttaaacaat atgaaccgag 2220
acttagcttt ccatttggtg agagaagtct ctgatttttt tegccagagc gaaccgcata 2280
gcccaatttc atttttggtt gaaaaagcga ttcgatgggg atatttatcc ttacctgagt 2340
tgctgcgaga aatgatgtcg gaacaaaacg gtgacgtctt tagtacgatt tttaatgccg 2400
ccggattgaa tcatctcgat cagggttttg tgcggagggt gactactcca acgggtgggca 2460
ttgaaagccc ccaaacacct caagcgaagc cttccgtttc ggatccgcga agtgttgaag 2520
agcatgtatc tcagacttcc cctgtagata cccaatctaa gcaagatcaa aaaccacaat 2580
catccgctac gtccgctctg agttggtaat tgtgtttaaa aaataaggaa aaatcatggc 2640
aagtatttac atgcgtgtaa gcggtcttca agttgagggc gcagcgacta tcggtcagct 2700
agaaaaggct gaaggtaaaa atgacgggtg gtttgcaatc aactcttact cttggggtgg 2760
cgctcgtaac gttgctatgg acatcggtaa cggcaccaat gcggattcag gcatggttgg 2820
cgtaagcgaa gttagcgtaa ctaaagaagt cgatgggtgt tctgaagacc tactgtctta 2880
tttattcaac ccaggtaaag acggtaaaac tgttgaggtt gcatttacta agccttctaa 2940
cgatgggtcaa ggtgcagacg tttacttcca agttaagcta gaaaaagcac gtttagtttc 3000
ttacaacgtg agcgggactg acggatctca accgtacgag agcctatctc tttcttacac 3060
ttctatttct cagaagcatc actatgagaa agaagggtgt gaactacaaa gcgggtggtgt 3120
tgtgacttac gacctaccga ccgggaaaaat gacttctggt aagtaattct ttcattagac 3180
atgccacggt aattggcatg tctatttcat gaatatctca ttttaggaca ccgttatggc 3240
attgaactca caacataagc gcgttagtaa gaaccggtc agcatcacct atgacgttga 3300
aacgaatggc gccgtaaaga cgaaagagct gccgtttggt gttggcgctc ttggcgactt 3360
ttcaggacac aaaccagaat cagaaaaagt tgatttagaa gagcgagagt tcacgggtat 3420
cgataaagac aacttcgata cagtgatggg gcaaattcac ccgcgtcttt cgtacaagg 3480
tgataacaag cttgctaatt atgatagcca gtttgaagtg aacttgagcc tccgttcgat 3540
gaaagatttc caccagaga acttagttga tnaaattgag ccgcttaa 3588

```

<210> 2

<211> 463

<212> PRT

<213> *Vibrio anguillarum*

<400> 2

```

Met Pro Leu Ser Lys His Gln Ile Glu Gln Leu Ser Lys Pro Leu Ser
 1             5             10            15

```

```

Asp Asp Ser Ile Cys Gly Val Tyr Leu Lys Leu Glu Lys Ser Ala Phe
      20             25            30

```

```

Arg Pro Leu Arg Asn Glu Phe Asn Val Ala Gln Thr Ala Leu Arg Lys
      35             40            45

```

```

Leu Ser Gln Asn Pro Ser Ala Asp Glu Arg Asp Ala Leu Gln Glu Ala
      50             55            60

```

```

Cys Leu Asn Lys Trp Lys Ile Leu Ser Asp Ser Leu Tyr Glu Gln Phe
      65             70            75            80

```

```

Ser Lys Thr Thr Arg Asp Ile Glu Leu Ile Ser Trp Phe Val Ala Ala
      85             90            95

```

```

Gln Phe Leu Leu Asp Thr Thr Leu Glu Ser Ala Ala Asn Ser Leu Glu
     100            105           110

```

Trp Leu Ala Asp Leu Ser Glu Lys His Trp Asp His Leu Asn Pro Val  
 115 120 125  
 Leu Pro Val Glu Thr Leu Lys Ser Asp Asp Asp Lys Gly Lys Glu Arg  
 130 135 140  
 Glu Gln Ala Asp Ala Lys Val Lys Ala Phe Phe Gln Leu Val Gly Asp  
 145 150 155 160  
 Ser Glu Glu Ser Ser Ile Leu Tyr Ala Pro Val Leu Gln Leu Pro Leu  
 165 170 175  
 Val Gly Glu Val Thr Phe Phe Asp Phe Gln Ser Ala Glu Arg Lys Gly  
 180 185 190  
 Glu Ile Ser Gln Leu Lys Ser Met Leu Thr Thr Thr Val Ala Gln Glu  
 195 200 205  
 Arg Phe Ala Ile Gln Phe Lys Met Glu Asn Ala Lys Arg Cys Val Thr  
 210 215 220  
 Gln Leu Asp Arg Leu Ser Ala Leu Val Ser Thr Lys Cys His Ser Leu  
 225 230 235 240  
 Gly Ser Gln Ser Thr Asn Phe Gly Phe Ala Lys Ser Leu Leu Thr Arg  
 245 250 255  
 Val Glu Asn Ala Leu Val His Leu Ser Gly Ile Lys Leu Ala Pro Lys  
 260 265 270  
 Ala Glu Ala Lys Thr Val Glu Gln Glu Val Ala Glu Ser Ser Val Ser  
 275 280 285  
 Glu Gly Glu Leu Pro Ser His Met Asp Thr Lys His Ile Glu Arg Ile  
 290 295 300  
 Pro Met Ala Ser Glu Gln Ala Gln Thr Val Ser Gln His Leu His Ala  
 305 310 315 320  
 Gly Asn Leu Ser Glu Leu Gly Asn Leu Asn Asn Met Asn Arg Asp Leu  
 325 330 335  
 Ala Phe His Leu Leu Arg Glu Val Ser Asp Tyr Phe Arg Gln Ser Glu  
 340 345 350  
 Pro His Ser Pro Ile Ser Phe Leu Leu Glu Lys Ala Ile Arg Trp Gly  
 355 360 365  
 Tyr Leu Ser Leu Pro Glu Leu Leu Arg Glu Met Met Ser Glu Gln Asn  
 370 375 380  
 Gly Asp Ala Leu Ser Thr Ile Phe Asn Ala Ala Gly Leu Asn His Leu  
 385 390 395 400  
 Asp Gln Val Leu Leu Pro Glu Val Ser Thr Pro Thr Val Gly Ile Glu  
 405 410 415

Ser Pro Gln Thr Pro Gln Ala Lys Pro Ser Val Ser Asp Pro Arg Ser  
420 425 430

Val Glu Glu His Val Ser Gln Thr Ser Pro Val Asp Thr Gln Ser Lys  
435 440 445

Gln Asp Gln Lys Pro Gln Ser Ser Ala Thr Ser Ala Leu Ser Trp  
450 455 460

<210> 3

<211> 176

<212> PRT

<213> *Vibrio anguillarum*

<400> 3

Met Ala Ser Ile Tyr Met Arg Val Ser Gly Leu Gln Val Glu Gly Ala  
1 5 10 15

Ala Thr Ile Gly Gln Leu Glu Thr Ala Glu Gly Lys Asn Asp Gly Trp  
20 25 30

Phe Ala Ile Asn Ser Tyr Ser Trp Gly Gly Ala Arg Asn Val Ala Met  
35 40 45

Asp Ile Gly Asn Gly Thr Asn Ala Asp Ser Gly Met Val Gly Val Ser  
50 55 60

Glu Val Ser Val Thr Lys Glu Val Asp Gly Ala Ser Glu Asp Leu Leu  
65 70 75 80

Ser Tyr Leu Phe Asn Pro Gly Lys Asp Gly Lys Thr Val Glu Val Ala  
85 90 95

Phe Thr Lys Pro Ser Asn Asp Gly Gln Gly Ala Asp Val Tyr Phe Gln  
100 105 110

Val Lys Leu Glu Lys Ala Arg Leu Val Ser Tyr Asn Val Ser Gly Thr  
115 120 125

Asp Gly Ser Gln Pro Tyr Glu Ser Leu Ser Leu Ser Tyr Thr Ser Ile  
130 135 140

Ser Gln Lys His His Tyr Glu Lys Glu Gly Gly Glu Leu Gln Ser Gly  
145 150 155 160

Gly Val Val Thr Tyr Asp Leu Pro Thr Gly Lys Met Thr Ser Gly Lys  
165 170 175

<210> 4

<211> 117

<212> PRT

<213> *Vibrio anguillarum*

<220>

<221> MOD\_RES

<222> (113)

<223> Variable amino acid

<400> 4

Met Ala Leu Asn Ser Gln His Lys Arg Val Ser Lys Asn Arg Val Ser  
1 5 10 15

Ile Thr Tyr Asp Val Glu Thr Asn Gly Ala Val Lys Thr Lys Glu Leu  
20 25 30

Pro Phe Val Val Gly Val Ile Gly Asp Phe Ser Gly His Lys Pro Glu  
35 40 45

Ser Glu Lys Val Asp Leu Glu Glu Arg Glu Phe Thr Gly Ile Asp Lys  
50 55 60

Asp Asn Phe Asp Thr Val Met Gly Gln Ile His Pro Arg Leu Ser Tyr  
65 70 75 80

Lys Val Asp Asn Lys Leu Ala Asn Asp Asp Ser Gln Phe Glu Val Asn  
85 90 95

Leu Ser Leu Arg Ser Met Lys Asp Phe His Pro Glu Asn Leu Val Asp  
100 105 110

Xaa Ile Glu Pro Leu  
115